SLEEP DYSFUNCTION IN PARKINSON'S DISEASE

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CERTIFICATE

This is to certify that the dissertation entitled **"Sleep Dysfunction in Parkinson's Disease"** is a bonafide original work of **Dr.S.VinothKanna,** in partial fulfillment of the requirements for D.M. Branch– I (NEUROLOGY) Examination of the Tamil Nadu Dr. M.G.R Medical University to be held in AUGUST 2013, under our guidance and supervision.

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DECLARATION

I hereby solemnly declare that this dissertation titled **"Sleep Dysfunction in Parkinson's Disease"** was done by me in Institute of Neurology, Madras Medical college and Rajiv Gandhi Government General Hospital, Chennai -3, under the guidance and supervision of **Prof.K.BHANU,D.N.B(MED).,D.M.,** Professor of Neurology, Institute of Neurology, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai. This dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University towards the partial fulfillment of requirement for the award of D.M Degree Branch I (NEUROLOGY).

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CERTIFICATE OF APPROVAL

To
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Dear Dr. S. Vinothkanna

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled " Sleep dysfunction in parkinson's diseases " No. 23112011

The following members of Ethics Committee were present in the meeting held on 22.11.2011 conducted at Madras Medical College, Chennai -3.

1.	Prof. S.K. Rajan. MD	-- Chairperson
2.	Prof.A. Sundaram MD Vice principal, Madras Medical College, Ch -3	-- Member Secretary
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We approve the proposal to be conducted in its presented form.

. Sd/ chairman & Other Members "

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

INTRODUCTION

Sleep is defined as a periodic reversible physiological state of loss of consciousness from which a person can be aroused by adequate sensory stimuli and it is necessary for the recoupment and well being of the individual. We spend around 8 hours per day for sleep which means 56 hours per week, 224 hours per month and 2688 hours per year (ie) almost nearly 1/3 of our lives we spent for sleep. Sleep helps in energy conservation, physical restoration, memory reinforcement and consolidation, thermoregulation, preserving synaptic efficiency and brain plasticity, immune function, brain growth and development.[2]

SLEEP DISORDERS

The International Classification of Sleep Disorders (ICSD-2, 2005) includes over 80 sleep disorders which can be divided into eight broad categories[1]. They are i) Insomnia ii) Sleep related breathing disorders iii) hypersomnia of central origin iv) circadian rhythm sleep disorders v) parasomnia vi) sleep related movement disorders vii) isolated symptoms, apparently normal variants, viii) other sleep disorders (physiological /environmental sleep disorders). Sleep related disorders affect the mood, behavior, work and quality of life

contributing to morbidity and mortality of the pre-existing medical illness. Their recognition and treatment can help in improving the functional ability of the individual. Sleep abnormalities in movement disorders especially parkinsonism is associated with decreased slow wave sleep and REM sleep, decreased total sleep time and sleep efficiency, prolonged sleep latency were intensively studied world over.

SLEEP AND POLYSOMNOGRAPHY

The invention of the EEG in 1929 and studies to understand consciousness, sleep, wakefulness in the era of 1930's and 1940's and the discovery of REM sleep in 1953 by Aserensky et al ushered in the golden age of sleep medicine. The objective documentation of the sleep and its related events is done using polysomnography (PSG). Based on physiologic criteria sleep is divided into two independent categories; Non rapid eye movement (NREM) and rapid eye movement (REM) sleep.

EVALUATION OF SLEEP DISORDERS

Approach to a patient with a sleep complaint includes, a detailed history of sleep, psychiatric, neurologic, medical, drug, family history and a standard sleep questionnaire along with polysomnography. The Epworth sleepiness scale is used to measure

daytime sleepiness. Various sleep questionnaires were used to assess the sleep disturbance. The nocturnal sleep disturbance and the daytime sleepiness were objectively measured by polysomnography and multiple sleep latency test (MSLT) respectively.

PARKINSON'S DISEASE

Parkinson's disease (PD) is a progressive neurodegenerative disorder associated with a loss of dopaminergic nigrostriatal neurons. It is named after James Parkinson, the English physician who in an "Essay on the Shaking Palsy" in 1817 described Parkinson's disease as "involuntary tremulous motion, with lessened muscular power, in parts not in action and even when supported, with a propensity to bend the trunk forward, and to pass from a walking to a running pace, the sense and intellect being uninjured." Sleep disorders have been mentioned since the first description of the extra-pyramidal diseases in James Parkinson's Essay on the Shaking Palsy, but only recently they have become the subject of attention, thanks to new acquisitions in clinical knowledge and polysomnography technology.

SLEEP DISTURBANCES IN PD

Nocturnal Sleep disturbance are common in PD but it is a complex issue having multiple causes. Insomnia, hypersomnia, and parasomnia are seen in PD. Nighttime awakenings and inability to fall

back to sleep are predominant complaints. Sleep latency is not a problem. Early insomnia may be due to medications (the alerting effect of levodopa) and late insomnia may be contributed by depressive symptoms. Hypersomnia in the form of excessive day time sleepiness occurs in PD. Community based prevalence of daytime somnolence was found in 15% of PD patients.

The most common parasomnia seen in PD was REM sleep behaviour disorder (RBD). RBD can precede the onset of PD by a mean of 3.7 years. (Iranzo et al, 2006)[3]. Night time sleep disturbances tends to be mild in early PD and the subjective sleep quality may not differ from age matched controls[4].With advancing disease the sleep disturbances are more prevalent. Even in early PD, the PSG may show increased muscle tone, abnormal movements during sleep like increased blinking, blepharospasm, tremor, periodic limb movements during sleep, rapid eye movement sleep behaviour disorder and respiratory abnormalities.

The non-motor symptoms of PD have recently become the focus of attention. In the following section the relevant studies in the field on non-motor symptoms of PD are discussed with particular emphasis on the sleep and its related complications in PD.

AIMS & OBJECTIVES

1) To evaluate the frequency and the nature of the sleep abnormalities in Idiopathic parkinson's disease.

2) To analyse the sleep architecture in Parkinson's disease using polysomnography and to correlate the results with the disease parameters.

REVIEW OF LITERATURE

Parkinson's disease (PD) is a progressive neuro degenerative disease characterised by asymmetrical motor manifestations. Although PD was considered primarily a motor disorder, recently the non-motor features like sleep disturbances, cognitive,autonomic disturbances have been recognized as important components of the disease causing significant disability.

Clinical Features of Parkinson's disease

Parkinson's disease (PD) is an age related disease which begins between 50 and 70 years of age, with increase in prevalence after sixth decade. PD has a gradual onset and progression and it is common in men. It commonly presents with rest tremor in one hand, associated with decreased arm swing and shoulder pain. The disorder remains asymmetrical throughout much of its course. Other motor symptoms include bradykinesia, rigidity, mask like facies, impaired gait and balance resulting in frequent falls, freezing and motor blocks.

The terminology parkinsonism is described by a syndrome characterized by a combination of six cardinal features[1]

1. Tremor at rest
2. Bradykinesia
3. Rigidity
4. Loss of Postural Reflexes
5. Flexed Posture
6. Freezing gait.

A combination of these signs is the basis for defining clinically definite, probable, possible parkinsonism. Definite parkinsonism requires atleast two of the above said features with one being resting tremor or bradykinesia. Probable parkinsonism includes resting tremor or bradykinesia alone and possible parkinsonism includes atleast two of the remaining four cardinal features.

Non-Motor Symptoms in Parkinson's disease

Non-Motor symptoms are recently recognized as a major cause of disability in PD, contributing significantly to the decreased quality of life.

The non-motor symptoms[1,9] are sensory disturbances, sleep disorders, autonomic dysfunction, mood disorders, psychiatric manifestations, cognitive decline etc. Autonomic symptoms of PD include reduced gastrointestinal transit time with postprandial bloating and constipation, increased urinary frequency, urgency, urge

incontinence, impotence, decreased sweating and orthostatic hypotension.

Cognitive and behavioral changes are common in PD. Attention and concentration decreases with features of executive dysfunction. Global dementia occurs in 30% of patients and the incidence increases in frequency with the age of the patient.Anxiety, Depression and other mood disorders are common in PD.

Sleep Disturbances in Parkinson's disease

Sleep disorders are very common in Parkinson's disease. Sleep disorders comes under the "non-motor components" of PD. It can predate the motor manifestations of PD. Patients may complain of difficulty in initiating sleep, fragmented sleep due to frequent awakenings in the night , early morning awakenings, inadequate night sleep followed by excessive daytime sleepiness (EDS), snoring, nightmares, hallucinations, vivid dreams, confusional arousals, panic attacks, periodic limb movements(PLMS), restless leg syndrome (RLS),REM sleep behavioural disorder etc.

In PD, these alterations are due to various factors that affects the initiation, continuity, and the maintenance of sleep. The factors being anatomical involvement of the sleep regulating structures(degeneration of hypothamic neurons, pendunculo pontine

nucleus,locus ceruleus,midbrain raphe nucleus etc),motor rigidity,depression,dysautonomic symptoms and by Anti-parkinsonian medications used in treating PD.Various studies indicate sleep disturbance ranges from 60-98%[10,11]. There is positive correlation with the disease severity, Schwab and England score, Unified Parkinsons Disease Rating Scale (UPDRS) part III, L-dopa score, rigidity and bradykinesia[12].

Sleep fragmentation is three times more common in patients with PD than in healthy controls (38.9% versus 12%)[11]. Defects are seen in the slow wave sleep(NREM stages III & IV), total sleep time, sleep latency and sleep efficiency. PD patients have more frequent awakenings and greater overall wake time than the controls. There is a relative increase in the stage I and stage II sleep.

Treatment with dopaminergic agents produces sleep disruption with an increase in the number of awakenings and increase in the stage I sleep duration[13]. The sleep disruption is seen more with the higher dose of the medication. Around 40% of the PD patients take sleeping pills more than the healthy elderly contemporaries[11]. The nature of sleep disturbance in the early stages of PD is not well documented and the sleep disturbancesdescribed in literature are mostly in the

advanced stage of Parkinsons Disease. There is a general observation that with advancing disease, sleep complaints become common.

Respiratory dysfunction during sleep occurs in PD which can include apnea and hypopnea. Vivid dreams and nightmares are very common[5.]Sleep disorders in PD are related to primary pathological changes of the disease itself, arousals due to immobility, co-morbid primary sleep disorders, and the side effects of anti-parkinsonian medications.

Sleep deprivation causes excessive day time somnolence. The consequences[1] of EDS were impaired performance and productivity, impaired short-term memory, attention, concentration, judgement and cognition, impaired quality of life, psychological stress, increased morbidity and mortality (increased likelihood of accidents).Excessive daytime sleepiness is seen in 15-51%[14] of PD patients. Factors contributing to excessive daytime sleepiness are motor disorders associated with PD, insomnia, mood and anxiety disorders, effect of drugs and concurrent medical illness.

The Sleep Disturbance in PD is explained by

1. Primary involvement of sleep regulating structures,
2. Secondary involvement through motor, depressive and dysautonomic Symptoms,
3. Tertiary involvement through pharmacologic measures.

Primary involvement of sleep regulating structures:

Various anatomic structures are involved in the generation and maintenance of the sleep-wake cycle in human beings. The cortex,brainstem, thalamus, hypothalamus, limbic system, basal ganglia are the structures involved in the generation of sleep . The substrates being pedunculo pontine nucleus, lateral dorsal tegmuntum, dorsal midbrain raphe nucleus, locus ceruleus, tuberomamillary nucleus of hypothalamus, peri-aqueductal grey matter of midbrain etc.They undergo degeneration resulting in sleep disturbance.

Many neurotransmitters like glutamate, gamma amino butyric acid, glycine, hypocretin/orexin, melanin-concentrating hormone, melatonin, histamine, acetylcholine, dopamine, serotonin, and noradrenaline are implicated in the regulation of sleep. The degenerative process may actually begin at a very early stage in some patients and at a later stage in others. Thus, the sleep disturbance may vary from patient to patient and it is further influenced by concomitant medications or associated conditions.

Secondary involvement through motor, depressive and dysautonomic Symptoms:

Rigidity, tremor and bradykinesia, are the cardinal features of PD. These symptoms recur at night, during the lighter stages of sleep resulting in nocturnal akinesia which gives rise to discomfort and sleep disturbance. Patients are also forced to sleep for long periods in the same posture, causing sensory disturbance like numbness and pain. Muscle cramps also causes sleep disturbance.Periodic limb movements (PLM) are more common in PD even in early untreated patients.

Tremor may be present for 30% of time spent in bed causing nocturnal wakefulness. It disappears in REM sleep and present with reduced amplitude in NREM sleep. Rigidity and cog-wheeling are also reduced but present during sleep. Sleep related respiratory muscle dysfunction is due to abnormal tone in upper airway muscles, incoordination of respiratory muscles, and fluctuations in muscle functioning. The immediate sensation on awakening is a sensation of suffocation interpreted as sleep apnea[6]. PD patients with severe sleep disturbance and excessive day time sleepiness have irregular sleep-wake pattern. As there is alteration in the circadian regulation in PD patients there is a change in the functioning of autonomic nervous

system[25] .Insomnia reported in 32% of the PD patients[26]. The most common complaints by the patients are defect in the sleep initiation, sleep fragmentation and early awakenings. The prevalence of insomnia increases with age.

Depression is the common cause of sleep disturbance in elderly. There is difficulty in falling asleep and remaining asleep. Early morning awakening is a cardinal feature seen in depression. Insomnia is the earliest sign of mood disturbance and it occurs before the clinical evidence of depression.40% of the PD patients have depression[27]. The causes of depression ranges from neurochemical imbalances associated with PD to the consequences of living with the chronic progressive degenerative illness. There is no correlation of the depression with age, disease duration, severity, and cognitive impairment. Depression in PD associated with sleep onset difficulties, and sleep interruptions. SSRIs are effective in treating depression in PD.

Psychosis affects one fifth of the PD patients[28] and causes sleep problems. Frequency of psychosis increases with age and it also correlates with cognitive impairment. Hallucinations can occur in any stage of PD either spontaneously or secondary to medications. Around 40% of PD patients have hallucinations[35]. Hallucinations are

associated with RBD. Hallucinators have more ESS score. Newer antipsychotics like Quetiapine, arpiprazole are effective in the management of psychosis without aggravating the disease[29].

50% of the PD patients complains of pain[30] due to foot dyskinesia which is related to the off state or insufficient dose of dopaminergic therapy. Adjustment of the dosages and analgesics provide relief.

The prevalence of cognitive impairment rises with age. In a cohort study[31], more than three quarters of the patients developed dementia during a 8 year study period. Early hallucinations and akinetic rigid phenotype are associated with increased risk of dementia.

Autonomic disturbances are common in PD[32]. Dysphagia, paroxysmal sweating are specific to PD. Nocturia, day time urge incontinence, constipation, impotence, hypothermia are related to the ageing process or may be secondary to anti parkinsonian medications. Nocturia is the commonest symptom encountered in clinical practice. There is a high prevalence of nocturia in PD. 80% of the PD patients passes urine 2 or more times per night and 33% of them urinate more than three times per night[33]. The frequency of nocturia correlates with

the disease severity. In a study conducted in a group of 41 idiopathic PD patients, 32 had urinary symptoms in the form of increased frequency in 27 cases (65%), urgency in 9 cases (21%), urge incontinence and dysuria in 1 case[34]. There is an increase in urinary frequency when the dopaminergic medication wears off. So a long acting medication given at the night will be helpful.Other autonomic features like night time blood pressure variablity or paradoxical hypertension occur at later stage of the disease[35].

Tertiary Involvement through Pharmacologic Treatment

Pharmacological treatmentinfluence the sleep in different ways, depending on the drug and its administration schedule. Anti-parkinsonian medications can both aggravate and relieve nocturnal symptoms. Levodopa plays a dual role. Low doses of levodopa have a sedating, sleep-enhancing effect, whereas higher doses have a stimulating, sleep-inhibiting effect. Respiration may be intially enhanced by entral levodopa stimulation and later inhibited by peripheral action of levodopa on chemoreceptor reflexes. Levodopa may also results in night time hallucinations. Levodopa may relieve night time akinesia and reduce the muscle tone in PD patients. As the levodopa wears off in the early morning hours, akineticepisodes

occursresulting in early morning awakenings. Nightmares are reported in 32% of PD patients. There is a positive correlation of the nightmares with the staging, severity and L-dopa dosage. Reducing the dose of dopaminergic medications and the anti-cholinergic agents helps to relieve the symptoms.

Symptoms of Sleep Disturbances in Parkinson's disease:

Insomnia:

Sleep initiation insomnia is uncommon.Sleep maintenance insomnia has been observed before the levodopa era. In this form of insomnia, the patient wakes after 2 to 3 hours feeling relatively refreshed and unable to sleep again. There is lack of consolidated sleep. The sleep remains fragmented throughout the night. In the daytime, sleepiness recurs and the patient takes multiple short naps. Although sleep is not consolidated, the total quantity of sleep over a 24 hour period is normal. Secondary factors may contribute including decreased body movements and nocturia, pain, anxiety, depression, vivid dreams.

Hypersomnia:

Excessive daytime sleepiness is defined as symptomatic daytime somnolence with frequent sleep periods. Pramipexole, a non-ergot dopmine agonist cause drowsiness and sudden irresistible naps.

The sleep attacks were reduced after the discontinuation of the drug. Another study showed no difference between non-ergots(ropinirole /pramipexole) and ergots(bromocriptine/cabergolin)and it concluded that daytime sleepiness correlates with autonomic failure, longer duration or advanced stage of the disease, advanced age of the patient, and male sex but not with use of any specific dopaminergic agonist.(Ondo et al)[36].

Parasomnia:

The most common parasomnia is the **Rapid Eye Movement Sleep Behaviour Disorder (RBD)**.RBD is characterised by loss of REM sleep related hypotonia associated with abnormal motor activities and the patients may enact the dreams causing injury to themselves or to the bed partners. RBD may be primary or secondary, most of them are due to neurodegenerative diseases like PD, MSA, corticobasal degeneration, DLBD, olivopontocerebellar atrophy, and PSP.In Narcolepsy,a degenerative disease of hypothalamus is characterised by REM onset sleep.

The prevalence of rapid eye movement disorder varies from 15 to 47%[21]. REM sleep behaviour disorder (RBD) predates the motor symptoms in PD in 52% of individuals (olson et al)[7] RBD is common in akinetic-rigid phenotype of PD. PD patients with RBD have high

incidence of cognitive impairment, impaired colour discrimination, diminished olfaction, dysautonomia, increased prevalence of sleep walking behaviour, less responsive to dopa and history of frequent falls. Increased muscle activity in REM sleep, which is an early sign of RBD is reported in asymptomatic patients who have PD[23]. Individuals with RBD have significantly increased risk of developing parkinsonismif there is decreased nigrostriatal dopaminergic activity in the functional imaging over the next decade. Dopaminergic medications, sedatives-hypnotics/tricyclic anti-depressants, and anti-cholinergics are reported to cause RBD[24].

Contribution of Motor Dysfunction to Sleep Disturbance in PD

Motor disorders that appear at night in PD include tremor, rigidity, bradykinesia, painful dystonia, dyskinesias, periodic limb movements, restless legs, akathisia, REM sleep behavior disorder.

Role of Tremor:

EMG recording of the muscles involved in tremor during wakefulness shows rhythmic repetitive muscle contractions during the NREM sleep. The repetitive muscle contraction is considered the equivalent of parkinsonian tremor during sleep which contributes to light and fragmented sleep. (Askenasy and Yahr)[37]

Role of Rigidity :

Although muscle tone decreases during the different stages of sleep, variable degrees of rigidity can persist in parkinsonian patients during the night, especially those who have motor fluctuations. This rigidity accounts for stiffness, mainly of axial distribution, and is a major contributor to nocturnal pain in PD. This is responsible for poor nocturnal mobility that manifest as impairment in making postural adjustments like difficulty turning over in bed. (Rye DB)[38].

Painful dystonia occur in the early morning, but dystonic spasms and postures, usually localized to the legs, can appear at any time during the night. The pathophysiology of nocturnal painful dystonia is similar to that of the off-period dystonia experienced by patients with motor fluctuation during the day. Levodopa-induced dyskinesias are more intense in the evening, due to cumulative effect of the recent levodopa doses. The alerting effect of Levodopa cause delayed onset of sleep. When the patient arouse from sleep at night the dyskinesias reappear and prevents the patient from going back to sleep. Nighttime motor manifestations is related to the deficit in the dopaminergic tone during the night as it well responds to the controlled release formulations of levodopa (Stocchie[39] et al, Iranzo[3] et al).

RESTLESS LEG SYNDROME (RLS)

It is the most common movement disorder, not commonly recognized. The diagnosis of RLS is made clinically and with the criteria based on International Restless Legs Syndrome Study Group (IRLSSG) established in 1995 (Walters, 1995) and later modified in 2003(Allen et al., 2003).The patients has an unpleasant, uncomfortable sensations in the legs predominantly in the evening or night hours which cause an intense urge to move the legs and the movements like stretching, walking relieves the unpleasant sensations partially or completely. It may associated with a positive family history, presence of periodic limb movements in sleep or wakefulness and response to dopamine.

The overall prevalence of RLS has been estimated at about 10% for all adult populations(North American and European populations) but appears to be much less in Asian surveys (1%-3%),suggesting ethnic and racial differences in RLS.Women have a greater prevalence, and has a gradually progressing course. Around 15% to 20% of patients complain of pain. The movements are predominantly present in the evening hours and as the disease progress the movements may be noted in the morning also.80% of the RLS patients have PLMS.RLS mainly causes difficulty in sleep initiation.

Neurological examination is usually normal in the idiopathic form of Restless leg syndrome.

It is proposed that dopaminergic nerve cell loss in the striatum is involved in the generation of PLMs in patients with PD[1]. Recent hypothesis states that reduced dopamine cellular function secondary to local iron deficiency is the pathophysiology behind RLS.Iron is an essential cofactor for tyrosine hydroxylase, the rate-limiting enzyme involved in dopamine synthesis, and iron deficiency decreases the number of dopamine D2 receptor binding sites, so the current research focus is centred on iron-dopamine dysfunction. Meta analysis of various studies showed the site of CNS involvement in RLS is the brain stem, but the spinal cord may be one of the probable site.

This disorder increases in prevalence with age and it is seen in 15% of the elderly patients. This movement causes frequent awakenings and arousals, thereby disrupting the sleep. 20.8% of the PD patients have RLS, which is twice that of the control population[20]. Ondo and his co-workers stated that PD preceded the development of RLS in 68% of the patients. They have also reported that RLS is not associated with high ESS score[20].

PERIODIC LIMB MOVEMENTS IN SLEEP

PLMS are stereotyped limb movements, present in the NREM sleep characterised by dorsiflexion movements of the ankle and flexion movements of the knee and hip for a period of 0.5 to 10 seconds with an average interval of 20 to 40 seconds and atleast 4 consecutive movements should be present.

PLMS is seen in at least 80% of patients with restless legs syndrome. PLMS occurs most commonly in RLS but may also occur in a large number of other medical, neurological, and sleep disorders and with medications like (e.g. SSRIs, tricyclic antidepressants) and even in normal individuals, particularly in those older than 65 years. PLMS without associated RLS cause repeated awakenings during sleep. There is also a growing body of evidence that PLMS may simply be a PSG observation and does not have any clinical significance.

PD patients show increase periodic limb movements (PLM) during REM and NREM sleep than the healthy controls. 15% of the PD patients had PLMs in a study done by Arnulf and his associates[19] and they concluded that there is no correlation between the PLM and EDSS score.

SCALES USED TO ASSESS SLEEP DYSFUNCTION IN PD

Studies on sleep disorders are conducted with questionnaire based scales that asses the subjective sleep disturbance and by PSG which objectively measures sleep. Common questionnaire used were PDSS, SCOPA-SLEEP, Epworth sleepiness scale(ESS).Cut off points taken to identify patients of PD with sleep disturbance were 82 for PDSS and 6 for SCOPA-S NS (night time sleep). (Martinez-Martin et al,)[40]. Studies have compared PDSS to SCOPA and found that both scales were reliable, valid and useful means to evaluate sleep disorders in PD.PDSS predominantly evaluate nocturnal sleep disturbances whereas SCOPA-S assesses nocturnal sleep disorders and daytime somnolence to a similar extent (Martinez-Martin et al)[40].

On comparing with the controls, PD patients had excessive daytime somnolence compared to controls (43 vs 10%), and similarly had excessive nighttime sleep problems (27 vs. 9%), or used sleep medications (17 vs 12%). In PD patients, depressive symptoms were a major contributor to nocturnal sleep problems. The nocturnal sleep problems were related to dopamine-agonist and levodopa dose, whereas daytime somnolence was related to age, dopamine-agonist dose, and disease severity. (Verbaan et al,)[41]

POLYSOMNOGRAPHY (PSG) FINDINGS IN PD:

Patients with PD have decreased total sleep time and frequent awakenings. Stage 2 NREM sleep show reduction in the sleep spindles and K complexes. Slow wave sleep (Stage 3 and Stage 4) is decreased. REM sleep shows increased alpha activity and it was hypothesized that it was due to early disconnection between generators of REM and NREM sleep in PD.It is debated whether REM sleep percentage is normal or reduced. Electromyographic atonia is periodically abolished in REM sleep. Repetitive blinking is seen in the beginning of the recording and blepharospasm is seen during slow wave sleep before the REM sleep episodes. Polysomnography has revolutionized the sleep assessment in PD.

SLEEP STUDIES IN PD

Studies have compared the subjective sleep perception against objective parameters obtained from polysomnography and there are also studies relating the loss of physiological sleep architecture and sleep fragmentation in relation to the severity of the disease process.

Happe[42] et al, compared the sleep parameters in parkinson's disease patients with the healthy elderly controls. The patients with PD showed reduced subjective sleep decreased sleep duration, reduced sleep efficiency compared with controls. The author concluded that

PD patients have objectively and subjectively disturbed sleep as compared to the healthy controls of same age group.

Diederich[43] et al, have made a correlation analysis of the sleep parameters with the disease duration.The sleep latency correlates directly with the disease duration.The total sleep time, deep sleep time, REM sleep time and sleep efficiency correlated inversely with the disease duration. It was concluded that in PD nocturnal sleep destructuring is related to the disease duration and it is independent of other major disease parameters.

Norlinah et al[44], in his study showed sleep fragmentation, periodic limb movement and sleep related breathing disorder correlates with the higher UPDRS course. The total sleep time and the sleep efficiency correlates poorly with the UPDRS scores.

Young et al[45], made a comparison of sleep disorders in mild vs Severe PD. Patients with mild (Hoehn and Yahr stage 1 or 2) and severe (Hoehn and Yahr stage 4 or 5) idiopathic Parkinsons's disease were recruited and underwent overnight polysomnography, autonomic function testing and assessed with questionnaire addressing their quality of life, mood, and drug dosages. Both groups slept poorly. Their sleep efficiency was decreased, and the architecture was fragmented. There was a significant increase in the number of voids

overnight in the severe disease group. It was concluded that the severity of Parkinson's disease didn't correlate with the change in the measured sleep parameters and other parameters like drug plays a major role in sleep disturbance. The motor/functional measures of disease severity correlates poorly with the sleep disturbance. Nocturia is an important factor which disturbs sleep, particularly in the severe disease group.

Kumar et al[46] assessed daytime sleepiness in patients with Parkinson's disease using the Epworth Sleepiness Scale (ESS). Patients with PD (n=49) and age matched controls (n=115) from movement disorders clinic of the All India Institute of Medical Science in New Delhi were evaluated. An ESS score of >8 was considered abnormal. The author concluded that higher Hoehn and Yahr staging and higher Unified Parkinson's Disease Rating Score was associated with excessive day time sleep as assessed by ESS and the sleep disturbance is more common patients with PD than the controls ($P < 0.001$).

The review of literature has revealed extensive knowledge about the sleep dysfunction in PD. We made an attempt to evaluate the subjective and objective sleep disturbance of Idiopathic parkinson's disease patients in our institute.

MATERIALS AND METHODS

STUDY DESIGN: Cross sectional study

STUDY SITE: This study was carried out in the Department of Neurology, Madras Institute of Neurology, Chennai.

STUDY PERIOD: December 2011 to December 2012.

INCLUSION CRITERIA:

Patients who fulfill the "UK Parkinson's Disease Society- Brain Bank Clinical Diagnostic Criteria" admitted in neurology ward/consulting in Neurology outpatient clinic in Rajiv Gandhi Government General Hospital.

EXCLUSION CRITERIA:

Patients who are bedridden associated with co-morbidities which affects the sleep like uncontrolled diabetes, LV dysfunction, Bronchial Asthma, Chronic obstructive Pulmonary disease, vascular Parkinsonism, head injury, dementia, Parkinson plus syndromes.

METHODS AND ANALYSIS:

1)Detailed history and neurological examination

2)Assessment of severity of Parkinsons disease using Unified Parkinsons Disease Rating Scale(UPDRS).

3)Sleep assessment using Parkinsons disease sleepiness scale(PDSS) and Epworth Sleepiness Scale(ESS)

4)Polysomnography.

SAMPLE SIZE:

50 patients suffering from Idiopathic Parkinsons Disease

STASTITICAL DATA ANALYSIS:

Pearson's Correlation Analysis and logistic regression, SPSS16

PARKINSONS DISEASE SEVERITY QUESTIONNAIRE

INSTRUMENTS:

1)Modified Hoen and Yahr staging

2)UPDRS

SLEEP QUESTIONNAIRE INSTRUMENTS:

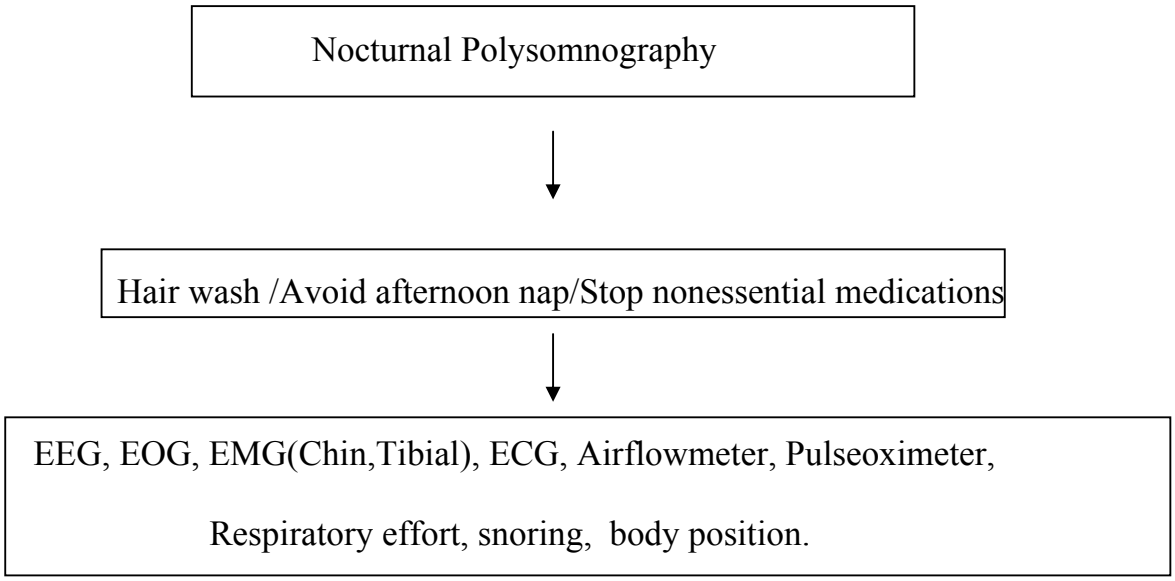
1)Parkinsons disease sleep scale(PDSS)

2)Epworth sleepiness scale(ESS)

POLYSOMNOGRAPHY RECORDING:

Patients with idiopathic pakinson's disease were subjected to overnight polysomnographic study using parameters like EOG, EEG, EMG,ECG,Oxygen saturation, Respiratory effort, air flow, body position.

Parts of Polysomnography (PSG)



Scoring of Sleep Study

The participants underwent overnight polysomnography which includes electroencephalogram to score sleep, an electromyogram on the chin and right anterior tibialis muscle, an electrooculogram to record eye movements, electrocardiogram, a nasal airflow sensor, chest and abdomen belts, a pulseoximeter, a snore microphone and body sensors.

Total sleep time (TST), sleep efficiency, sleep latency, sleep stages, arousals, snore indices and respiratory events were scored. The scoring of sleep was done according to the rules and technical specifications given by AASM Manual for the scoring of sleep and

associated events. An Epoch is a 30 second sequence, and throughout the study, sleep is scored in 30 second sequential epochs.

Stage W (Wakefulness) is defined as alpha rhythm 8 -13 HZ activity recorded over the occipital region with eyes closed attenuating with eye opening, eye blink, reading and rapid eye movements seen.

Stage 1 (N1) comprises 3 to 8% of sleep. The features being alpha wave mixed with theta wave with few beta waves, slow rolling of eyeballs, vertex waves with duration less than 0.5 seconds maximally seen over the central region and positive occipital sharp transient waves

Stage 2 (N2) comprises 45 to 55% of sleep. The features being predominantly theta waves and 20% delta waves. K complex and the sleep spindles are seen in this stage. K complex is a well defined negative sharp wave immediately followed by a positive component standing out from the background EEG with total duration more than 0.5 sec maximally seen in the frontal region. The sleep spindles are trains of distinct waves with frequency 11-16 Hz maximally seen in the central leads.

Stage 3 and 4 (N3) also called slow wave sleep with 20 to 50% of delta wave seen in stage 3 and more than 50% delta wave seen in stage 4. There will be no eye movements and the EMG shows hypotonia.

Stage R (REM Sleep) characterized by rapid eye movement which are conjugate irregular sharply peaked eye movements with an initial deflection lasting less than 500 msec. EEG shows low voltage irregular theta and delta activity, saw tooth waves. EMG shows hypotonia or atonia.

Sinus tachycardia was scored during sleep for a sustained sinus heart rate greater than 90 beats per minute for adults and bradycardia during sleep for a sustained heart rate of less than 40/min. Cardiac asystole for a pause more than 3 sec.

While scoring Periodic Leg Movements (PLMs) the minimum duration of a LM event is 0.5 sec and max is 10 sec. The minimum amplitude elevation was 8 μ V above the resting EMG. The LM stops when the variability from baseline resting EMG is ≤ 2 μ V.

REM sleep Behaviour Disorder (RBD) was defined as sustained tonic muscle activity in REM sleep i.e, an epoch of REM sleep with at least 50% of the duration of the epoch having a chin EMG amplitude, greater than the minimum amplitude in NREM.

The patients for our study were recruited from the Neurological services. The number of patients recruited were 50 members.All of them underwent sleep assessment using standard questionnaire and overnight polysomnography.

RESULTS

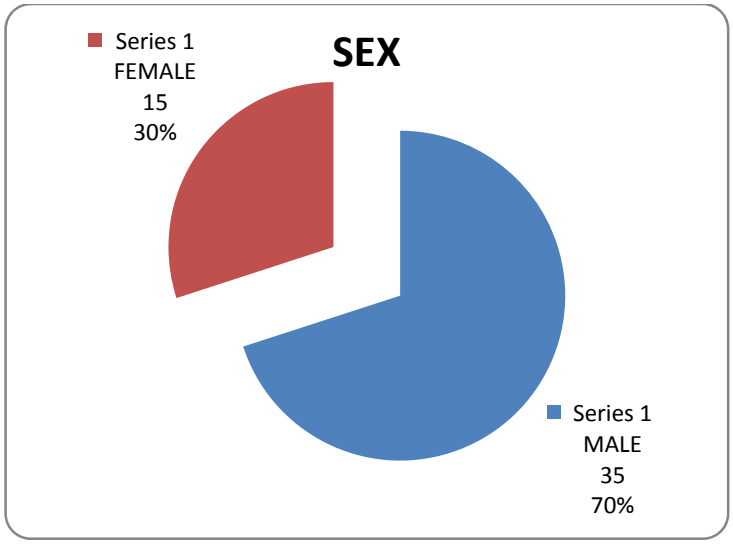
Fifty patients of Idiopathic Parkinson's disease were recruited based on United Kingdom Parkinson's Disease Society brain bank Criteria for the sleep study. All of them underwent clinical assessment. Their staging and severity was scored using Hoehn and Yahr staging system and Unified Parkinsons Disease Rating Scale part III respectively.

Subjective sleep disturbance was assessed using standard sleep related questionnaire (Parkinsons Disease sleepiness scale). They were asked about their nature of sleep disturbance. Disturbed sleep was reported by 35 patients. Of them 30 have difficulty in falling sleep and 24 have difficulty in maintaining the sleep due to frequent awakenings. Most of the patients told that they woke up in the night mainly for passing urine. Objective sleep analysis was done using overnight polysomnography. The day time disturbance was assessed using Epworth sleepiness scale. ESS Score more than ten was considered significant. Day time somnolence was reported by 15 patients.

DEMOGRAPHIC PROFILE

SEX

	Frequency	Percent	Valid Percent	Percent
FEMALE	15	30.0	30.0	30.0
MALE	35	70.0	70.0	100.0
Total	50	100.0	100.0	



The study participants were 35 (70%)males and 15 (30%)females with the age group ranges from 46 to 70 years(mean age is 57.16 years).Females belong to the age group between 48 to 70 years(mean age 59.73years) and age range in the males lie between 46 to 70 years(mean age 56.05 years).

AGE

		Descriptive Statistics		
	Number	Minimum	Maximum	Mean
AGE	50	46.00	70.00	57.1600
MALE	35	46	70	56.05
FEMALE	15	48	70	59.3

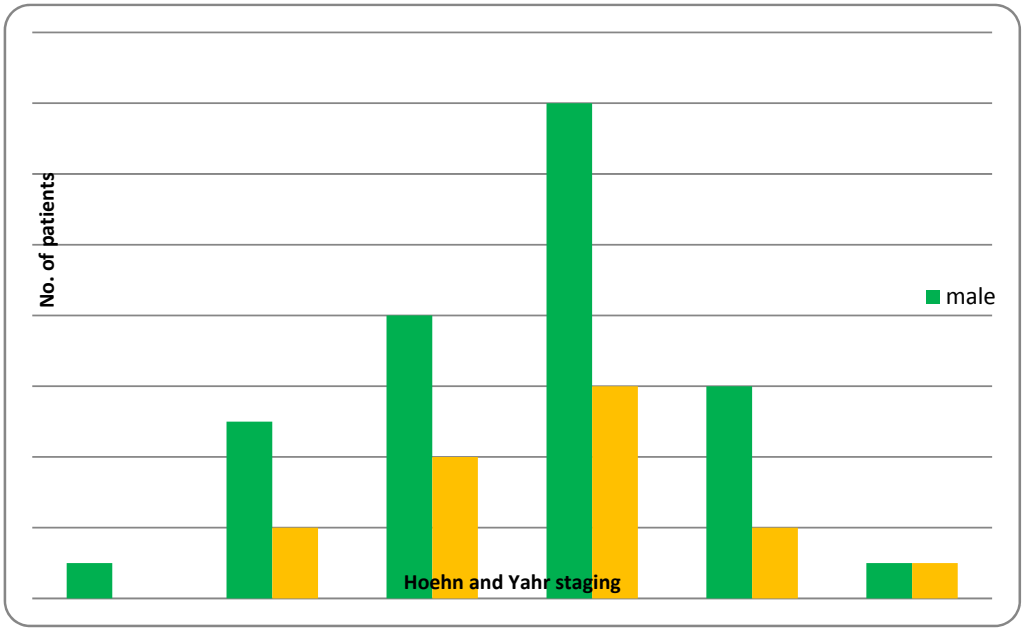
DURATION

		Descriptive Statistics			
	N	Minimum	Maximum	Mean	Std. Deviation
DURATION	50	1.00	12.00	5.3000	2.29463

The duration of the disease ranges from 1 year up to 12 years with the mean duration of 5.3 years. More than 50% (n=26) of the patients the duration of the disease was between five to ten years. The duration was more than 10 years in four of the patients.

STAGING (Hoehn and Yahr)

		Descriptive Statistics			
	N	Minimum	Maximum	Mean	Std. Deviation
STAGING	50	1.00	5.00	2.9100	.80616



Most of the patients (n=40) had a Hoehn and Yahr score of 3 or less. Only 20% (n=10) of the patients had a score of >3. Eight patients comes under stage 4 and two patients comes under stage 5.

SEVERITY

The severity of the disease assessed using UPDRS motor score. It ranges between minimum score of 10 and a maximum score of 40, the mean value is 25.3.

		Descriptive Statistics			
	N	Minimum	Maximum	Mean	Std. Deviation
SEVERITY	50	10.00	40.00	25.3600	7.23585

CORRELATION ANALYSIS

CORRELATION ANALYSIS	DURATION	STAGING
SEVERITY Pearson Correlation	.903**	.872**
Sig. (2-tailed)	**<0.05**	**<0.05**
N	50	50

The severity of the disease when correlated with the disease duration and Hoehn and Yahr staging showed a significant positive correlation **(p<0.05).**

PARKINSONS DISEASE SLEEPINESS SCORE (PDSS)

There are 15 questions which rates the sleep based on the experience during the past week .For each question the minimum score is zero and the maximum score is ten. Score 150 is maximum normal score. In our study the PDSS score ranges from 80 to 150 with the mean value of 115.90.

		Descriptive Statistics			
	N	Minimum	Maximum	Mean	Std. Deviation
PDSS	50	80.00	150.00	115.90	22.02804

CORRELATION ANALYSIS

		DURATION	STAGING	SEVERITY
PDSS Pearson Correlation		-.831**	-.826**	-.955**
Sig. (2-tailed)		**<0.05**	**<0.05**	**<0.05**
	N	50	50	50

The subjective sleep assessment using PDSS score correlates positively with the duration of the disease, staging and the severity of the disease (ie)with progression of the disease there is a significant drop in the PDSS score.

EPWORTH SLEEPINESS SCORE (ESS)

ESS assess the chance of falling asleep in the morning. It carries 8 questions, each questions carries a score of zero to three. A score of ≥ 10 is considered abnormal. Day time somnolence was reported by 15 patients and it is predominantly seen in whom, the duration of the disease is more and the staging and the severity of the disease were in higher range.

		Descriptive Statistics			
	N	Minimum	Maximum	Mean	Std. Deviation
ESS	50	.00	16.00	5.8600	5.42861

In our study the ESS score ranges from zero to sixteen with a mean value of 5.86.

POLYSOMNOGRAPHY ANALYSIS

TOTAL SLEEP TIME

The total sleep time ranges from 210 (3hr 30min)minutes to 445(7hr 25min) minutes with the mean value of 310(5hr10 min).Total sleep time is reduced in 40 patients.(80%)

	N	Minimum	Maximum	Mean	Std. Deviation
TSTmin	50	210.00	445.00	310.30	45.812

Correlation of the total sleep time with the duration, staging, severity, PDSS Score, showed strong positive correlation**.(p<0.05).**The total sleep time is significantly reduced as the disease progress and higher the staging and severity of the disease.

		DURATION	STAGING	SEVERITY	PDSS
TSTmin	Pearson Correlation	-.762**	-.745**	-.748**	.738**
Sig. (2-tailed)		**<0.05**	**<0.05**	**<0.05**	**<0.05**
N		50	50	50	50

Latency of sleep

It is the time taken to fall asleep after going to the bed. The normal latency of sleep is 15 to 20min.The range of this parameter in our study is between 2 minutes to 50 minutes with the mean value of 22.3 minutes.

		Descriptive Statistics			
	N	Minimum	Maximum	Mean	Std. Deviation
LATENCY	50	2.00	50.00	22.3600	11.45846

Prolongation of latency of sleep indicates defect in the initiation of sleep. Latency is prolonged in 26 patients (>50%).

Sleep efficiency:

Sleep efficiency is ratio of number of hours slept divided by number of hours spent in the bed. The normal sleep efficiency is≥ 85% which is seen only in 12 of our patients. The sleep efficiency ranges between 55% to 94% in our study with a mean value of 72.9%.

		Descriptive Statistics			
	N	Minimum	Maximum	Mean	Std. Deviation
EFFICIENCY	50	55.00	94.00	72.9000	9.55809

STAGES OF SLEEP

There is a significant increase in the N1N2 stages of NREM sleep associated with a decrease in the slow wave sleep(N3) in 80% of our study group (p value <0.05)

No.	NI N2 STAGE	N3 STAGE	PERCENTAGE
40 PATIENTS	Increased	Decreased	80%
10 PATIENTS	Normal	Normal	20%

	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	-1.386	.354	15.374	1	**<0.05**	.250

REM SLEEP

Among the 50 patients, 10 patients in our study group had 3 Rapid Eye Movement sleep episodes , 37 patients had 2 REM sleep episodes and 3 patients had only 1 REM sleep stage. The overall duration of REM sleep in the total sleep time is reduced and REM sleep onset latency is also prolonged (>2 hours) in 80% (n=40) of our patients.

REM sleep behavioural disorder (RBD) was seen in 10 of our patients (20%) and it showed no correlation with duration, staging, severity of the disease and the sleep scores.

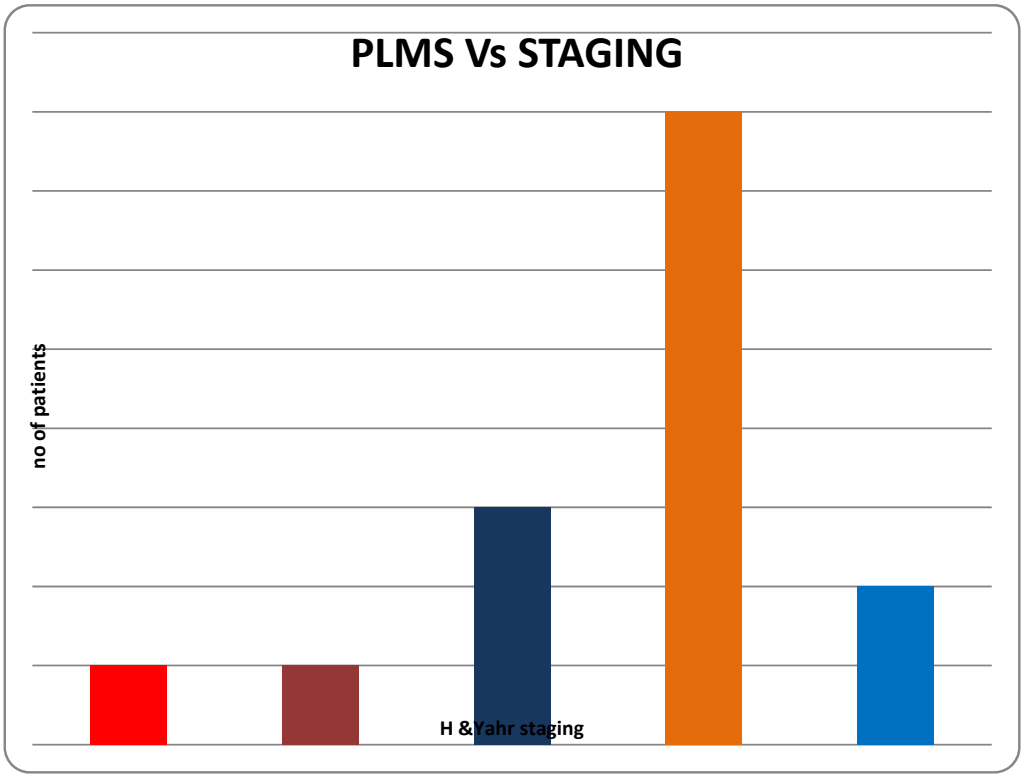
Periodic Limb Movements in sleep (PLMS)

These repetitive stereotyped movements present in NREM sleep were seen in 15 of our patients. It is scored as PLMS index. It is expressed as number of PLMS per hour of sleep. The upper limit of the normal PLMS index is five. As per our correlation analysis, the frequency of the periodic leg movements increases with the increase in the duration of the disease and higher the staging and severity of the disease.

Pearsons correlation analysis shows significant positive correlation (p value <0.005) of PLMS with disease parameters like

duration, staging, severity of the disease and sleep scores like PDSS and Epworth sleepiness score

A maximum number of 8 patients in stage 4 had PLMS, 2 patients in stage 5 and 3 patients in stage 3 had PLMS.



CORRELATION ANALYSIS OF PLMS WITH DISEASE PARAMETERS:

		DURATION	STAGING	SEVERITY	PDSS	TSTmin	MAIN
PLMS	Pearson Correlation	.557**	.647**	.506**	-.561**	-.498**	-.412**
	Sig (2 tailed)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	N	50	50	50	50	50	50

RESTLESS LEG SYNDROME

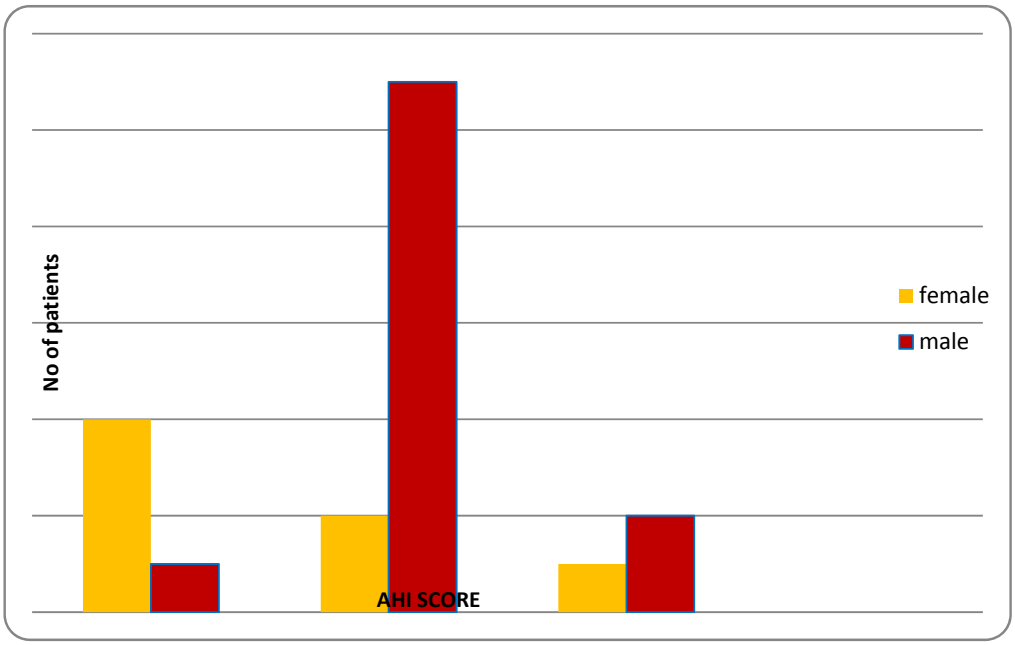
RLS was seen in 10 patients (20%), 4 of them were female. All the patients in our study having RLS had PLMS (100%). Sleep latency is prolonged in nine of the ten patients having RLS. Presence of RLS correlates significantly with the duration of the disease and the disease severity and staging .

APNOEA-HYPOPNEA INDEX

Documented Apnoeic and hypopneic spells were noted in 21 patients in our study. Classification of severity of Sleep Disordered Breathing (SDB) is based on AHI scoring. AHI score<5 is normal; 5-15 is mild SDB; 15 – 30 is moderate SDB, >30 is severe SDB .The distribution of AHI index ranges between 0 to 20 with the mean value of 3.66. AHI index didn't show a significant correlation with the disease parameters in correlation analysis **(p value >0.05)**

		DURATION	STAGING	SEVERITY	PDSS	TSTmin	MAIN
AHI	Pearson Correlation	.043	.167	.221	-.260	-.071	-.091
	Sig(2-tailed)	.766	.247	.123	.068	.625	.528
	N	50	50	50	50	50	50

AHI INDEX



SNORING

Snoring is expressed as snore index, which is the number of snore events per hour. Snoring was seen in 14 patients and it showed significant correlation with the Epworth sleepiness score and PDSS Score. **(p value <0.05)**

		SCORE	df	Sig
SNORING	PDSS			
		4.008	1	**.045**
	ESS	9.635	1	**.002**

DISCUSSION

Sleep disorders are common in Parkinson's disease(PD). Nocturnal sleep disturbance and excessive day time somnolence are more frequent in patients with PD than the healthy controls. The prevalence and the pattern of sleep disturbance is evaluated through this study. The study group consists of 50 patients with age group ranging between 46 to 70 years with varying duration, staging (based on Hoehn & Yahr staging) and severity (based on UPDRS Part III motor score).Their sleep related issues were assessed with standard sleep questionnaire and objective assessment was done using polysomnography recording.

Evaluation with sleep questionnaire

Patients with PD were evaluated with Parkinson's disease sleepiness scale and Epworth sleepiness scale. An ESS score of more than 10 is considered significant. Their subjective sleep quality scores and daytime somnolence scores were noted. Reduced sleep quality were noted in 70% of our patients and excessive day time somnolence was reported in 30% of our patients indicating more of nocturnal sleep disturbance which is in contradiction to the study done by Verban et

al[41] stating that excessive day time somnolence (43% Vs 10% controls) was more common than nocturnal sleep disturbance in PD.

We correlated the PDSS Score and ESS score with the disease parameters and it correlated positively with the disease duration, higher staging and severity of the disease ($p< 0.05$).Our observation is similar to the results of the study done by Kumar et al[46] showing excessive day time somnolence in PD patients when compared to the age matched controls and showed a positive correlation with the higher H &Y staging and higher UPDRS score. A similar study done by Perez-cloret et al[47] showing that PD severity and depression scores correlate significantly with the diminished nocturnal sleep and excessive daytime sleepiness.

This implies that neuronal degeneration in the motor areas and sleep centres progress simultaneously,as the sleep disorders parallels with the disease progression(young et al)[45]

SLEEP PARAMETERS

TOTAL SLEEP TIME

Total sleep time is reduced in 40 patients (80%) in our study. The total sleep time ranges from 210 (3hr 30min) minutes to 445 minutes (7hr 25 min) with a mean value of 310 minutes (5hr 10min).The reduction in the total sleep time strongly correlates

positively with the disease duration, severity and staging of the disease. The observation is similar to the study done by Diederich NJ et al[54], in which he concluded that the total sleep time, deep sleep time, REM sleep time and sleep efficiency (SE) were inversely correlated with disease duration and severity. A similar observation of reduction in the total sleep time in Parkinsons Disease was seen in the study done by Dhawan et al[55.]

SLEEP LATENCY

The latency of sleep is prolonged in 26 patients (52%) with a maximum latency upto 50 minutes and with a mean latency duration of 22.36 minutes. The other investigators also observed prolongation of sleep latency in PD patients upto 30.7 minutes (Kaynak et al, 2005)[50] and 32.6 min (Wetter et al)[47]. The latency of sleep in PD is prolonged than the normal healthy elderly individuals who tends to fall asleep within the normal 20 minutes (Boselli et al)[49.]

SLEEP EFFICIENCY

The normal sleep efficiency is$\geq$ 85% which is seen only in 12 of our patients. Sleep efficiency is reduced in 38 patients (76%) which is higher than the previous studies which showed reduced sleep efficiency between 69.2 $\pm$ 17.0 (Wetter et al,2000)[48]. This sleep

efficiency in PD patients was much less than the normal healthy individuals (Boselli et al)[49.]

STAGES OF SLEEP

Sleep in polysomnography is divided into 4 stages [stage 1 (N1)/ stage 2 (N2)/ stage 3 &4 (N3) / REM sleep].The time spent in N1 N2 stages of sleep increased in 40 (80%) of our patients and deep sleep and REM sleep were decreased in 40 (80%) of our patients.This results showed significant impact of the disease process with the sleep stages. Our findings correlate with the study done by Askenasky, Aldich , and Avidan [51] showing that lighter stages of sleep increase and slow wave sleep and REM sleep decreases in PD.

RBD (REM SLEEP BEHAVIOURAL DISORDER)

RBD is the loss of tone in REM sleep associated with acting out of dreams resulting in violent movements of the limbs associated with injury to self or the partner. In our study, RBD is seen in ten patients (20%) and it showed no correlation with the disease parameters whereas Gagnon etal[53] reported that 33 patients of PD with the mean age group of 68.7 $\pm$ 7.7 years with the mean disease duration of 7.7 $\pm$5 had RBD 33 % with REM muscle atonia in 58% of the patients.

PLMS (PERIODIC LIMB MOVEMENTS IN SLEEP)

PLMS is a significant non-motor disorder in PD causing sleep disturbance. PLMS is expressed as PLMS index. It is the number of events in one hour. PLMS score of $\geq$5 is considered abnormal. Our study showed PLMS in 18 patients (36%). Other studies showed PLMS of 22.02 $\pm$ 3.6 (kaynaket al)[49] and 55.4 $\pm$ 3.47 (Wetter et al)[47]. PLMS is associated with arousal and contribute to significant nocturnal sleep disturbance. It is significantly higher than normal healthy age matched controls (Wetter et al, 2000)[47]. PLMS significantly correlates with the staging, severity,duration of disease and sleep scores.

RESTLESS LEG SYNDROME

10 of our patients have RLS. All the patients in our study having RLS had PLMS (100%).Around 9 patients having RLS were found to have prolonged sleep latency. RLS also correlates significantly with the duration of the disease and the disease severity and staging , and the sleep scores. Ondo and his colleagues in their study showed that 20.8% of the PD patients have RLS which is twice that of the normal control population .Thus the prevalence of RLS in our study is similar to the study reported by Ondo.

SLEEP DISORDERED BREATHING (SDB)

SDB are apnoea/hypopnea and the etiology may be obstructive, central or mixed. Classification of severity of SDB is based on AHI scoring. AHI score<5 is normal; 5- 15 is mild SDB; 15 – 30 is moderate SDB, >30 is severe SDB. AHI>5 is taken into consideration. The most common type of SDB is the obstructive sleep apnoea (Arnulfetal, 2002)[52.] In our study, obstructive sleep apnoea was seen in 21 out of 50 (42%) patients with AHI >5. The AHI score didn't correlate with the disease duration, severity, staging and the sleep scores, Whereas a study done by Arnulf et al[52] showed a positive correlation of AHI score with the advancement of PD.

Snoring is expressed as snore index, which is the number of snore events per hour. In the present study, the snoring was observed in 14 patients (28%) which showed a significant correlation with the ESS score and PDSS score. Snoring is mainly due to impaired upper airway dynamics in PD.

Based on the results of our study it is very clear that as the disease progresses in severity and as the disability due to the disease increases there is a proportionate decrease in the normal sleep pattern in the patients. Sleep is thus directly and strongly correlated with the disease process. Some of the previous studies proposed that sleep and

the motor centres are differently affected in PD and the rate of degeneration of one is different from the other and hence they concluded that, sleep parameters doesn't correlate with the motor severity. But our study clearly showed that except certain parameters, most of the variables correlate significantly with the disease severity and the disability scores. Hence, both the sleep and motor centres are involved in PD and degeneration of both the centres occur parallel to each other at a varying pace.

CONCLUSION

1. Sleep disturbance occurred in 80% of the patients with Idiopathic Parkinson's disease.
2. Total sleep time is significantly decreased in patients with increased severity, staging and duration of the disease.
3. There is a significant prolongation in the sleep latency and the sleep efficiency is also markedly diminished.
4. Patients spent less time in slow wave sleep (N3) and there is significant prolongation of N1/N2 stages of sleep.
5. The mean REM sleep duration is also reduced.
6. REM sleep behaviour disorder is seen in 20% of the patients which did not correlate with the disease parameters.
7. Periodic limb movements in sleep is noted in 36% of patients and Restless leg syndrome is noted in 20% of our patients. They showed a significant positive correlation with the progression of the disease and higher staging and severity.
8. Sleep disordered breathing is noted in 42% of the patients which did not correlate with the disease parameters and sleep scores.
9. Snoring is noted in 28% of patients and it correlated well with the Epworth sleepiness score.

Sleep architecture is markedly affected in patients with Parkinson's disease. The latency of sleep is prolonged causing difficulty in falling asleep. The sleep efficiency is grossly diminished as there is defect in the maintenance of sleep due to frequent awakenings. Periodic limb movements in sleep, restless leg syndrome, and obstructive sleep apnoea also contribute to the sleep fragmentation resulting in defective day time functioning. It is essential that all the patients with Parkinson's disease should be evaluated for sleep disorders so that appropriate intervention can be taken to improve their quality of life.

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REFERENCES

1) G.Bradley,DM,FRCP et al,Neurology in clinical practice,6TH Edition ISBN:978-1-4377-0434-1,Elsevier saunders.
2) Madeleine et al, continuum lifelong learning neuro 2007, 13(3); 31-84.
3) Iranzo et al,2006 REM sleep can precede the onset of PD by 3.7 years.
4) Cartee J, Caroll S, Lannon MC. Sleep disruption in untreated pakinsons disease neurology 1990; 40 (lippe 1) : 220-5.
5) Arnulf,L, and Leu-Semenescu,S. (2009). Sleepiness in Parkinson`s disease. Parkinsonism Relat. Disord. 15, S101-S104
6) Hogl et al,2010Movement Disorders Vol. 25, No. 16, 2010, pp. 2704–2716 2010 Movement Disorder Society
7) Olson E, Boeve B, Silber M. Rapid eye movement sleep behavior disorder:demographic, clinical, and laboratory findings in 93 cases. Brain 2000;123: 331–9.
8) Allen RP, Picchietti D, Hening WA, Trenkwalder C, Walters AS, Montplaisi J, Restless Legs Syndrome Diagnosis and Epidemiology workshop at the National Institutes of Health, International Restless Legs Syndrome Study Group ;Sleep Med. 2003;4(2):101.

9) Ergun Y Uc, Jon Tippin, Kelvin L Chou, Bradley A Erickson, Kevin C Doerschug, Decontee M Jimmeh FletcherNon-motor Symptoms in Parkinson's Disease US Neurology, 2011;7(2):113-9

10) Lees AJ, Blackburn NA, Campbell VL. The nighttime problems of Parkinson's disease.Clin Neuropharmacol 1988;11:512–9.

11) Tandberg E, Larsen JP, Karlsen K. A community-based study of sleep disorders patients with Parkinson's disease. Mov Disord 1998;13:895–9.

12) Kumar S, Bhatia M, Behari M. Sleep disorders in Parkinson's disease. Mov Disord 2002;17:775–81.

13) Brunner H, Wetter TC, Hoegl B, et al. Microstructure of the non-Rapid Eye Movement Sleep Electroencephalogram in patients with newly diagnosed Parkinson's disease: Effects of dopaminergic treatment. Mov Disord 2002;17: 928–33.

14) Ondo WG, Vuong KD, Khan H, et al. Daytime sleepiness and other sleep disorders in Parkinson's disease. Neurology 2001;57: 1392–6.

15) Shill H, Stacy M. Respiratory function in Parkinson's disease. Clin Neurosci 1998;5:131–5.

16) Ferini-Strambi L, Franceschi M, Pinto P, et al. Respiration and heart rate variability during sleep in untreated Parkinson patients. Gerontology 1992;38:92–8.

17) Apps MC, Sheaff PC, Ingram DA, et al. Respiration and sleep in Parkinson's disease.J Neurol Neurosurg Psychiatry 1985;48:1240–5.

18) Hogl B, Seppi K, Brandauer E, et al. Increased daytime sleepiness in Parkinson's disease:a questionnaire survey. Mov Disord 2003;18:319–23.

19) Arnulf I, Konofal E, Merino-Andreu M, et al. Parkinson's disease and sleepiness: an integral part of PD. Neurology 2002;58:1019–24

20) Ondo WG, Vuong KD, Khan H, et al. Daytime sleepiness and other sleep disorders in Parkinson's disease. Neurology 2001;57:1392–6.

21) Wetter TC, Trenkwalker C, Gershanik O, et al. Polysomnographic measures in Parkinson's disease: A comparison between patients with and without REM sleep disturbances. Wien Klin Wochenschr 2001;113:249–53.

22) G.Bradley,DM,FRCP et al,Neurology in clinical practice,6TH Edition ISBN:978-1-4377-0434-1,Elsevier saunders (page 1682,chapter 68)

23) Sonka K, Juklickova M, Hnidkova P. [Manifestations of abnormal behavior during REM sleep in all-night polysomnography in patients with Parkinson disease]. Sb Lek 2000;101:353–6.

24) Onofrj M, Luciano AL, Thomas A, et al. Mirtazapine inducesREMsleep behavior disorder(RBD) in parkinsonism. Neurology 2003;60:113–5.

25) Bruguerolle B, Simon N. Biologic rhythms and Parkinson's disease: a chronopharmacologic approach to considering fluctuations in function. Clin Neuropharmacol 2002;25:194–201.

26) Kumar S, Bhatia M, Behari M. Sleep disorders in Parkinson’s disease. Mov Disord 2002;17:775–81.

27) Cummings JL. Depression and Parkinson’s disease: a review. Am J Psychiatry 1992;149:443–54.

28) Cummings JL. Managing psychosis in patients with Parkinson’s disease.NEngl JMed 1999;340:801–3.

29) Pollak P. Rev Neurol (Paris) 2002;158(Spec no 1):S125–31.

30) Shulman LM, Wen X, Weiner WJ, et al. Acupuncture therapy for the symptoms of Parkinson’s disease. Mov Disord 2002;17:799–802.

31) Aarsland D, Andersen K, Larsen JP, et al. Prevalence and characteristics of dementia in Parkinson disease: an 8-year prospective study. Arch Neurol 2003;60:387–92.

32) Zesiewicz TA, Baker MJ, Wahba M, et al. Autonomic nervous system dysfunction in Parkinson’s disease. Curr Treat Options Neurol 2003;5:149–60.

33) Lees AJ, Blackburn NA, Campbell VL. The nighttime problems of Parkinson’s disease.Clin Neuropharmacol 1988;11:512–9.

34) Zesiewicz TA, Baker MJ, Wahba M, et al. Autonomic nervous system dysfunction in Parkinson’s disease. Curr Treat Options Neurol 2003;5:149–60.

35) Mitra and chudhuri, 2009.Parkinson's Disease, Second EditiRonald F. Pfeiffer, Zbigniew K. Wszolek, and ManuchairEbadiCRC Press 2012,Pages 291–300

36) Ondo et al, 2002 Daytime sleepiness and other sleep disorders in Parkinson’s diseaseNeurology October 23, 2001 57:1392-1396

37) Askenasy and Yahr M.D ,1990 Parkinsonian tremor loses its alternating aspect during non-REM sleep and it is inhibited by REM sleep. JNNP 53, 749-53

38) Rye DB, 1997 Parkinson's Disease, Second Edition,Ronald F. Pfeiffer, Zbigniew K. Wszolek, and ManuchairEbadi,CRC Press 2012,Pages 291–300 Chapter 25. Insomnia and Excessive Daytime Sleepiness in Parkinson’s Disease

39) stocchie et al,1998 controlled relaeseo of levodopa prevent night time motor fluctuations

40) Martinez-Martin et al, 2008.Parkinson's Disease Volume 2011 (2011), Article ID 354760, 8 pages doi:10.4061/2011/354760

41) Verbaan D, van Rooden SM, Visser M, Marinus J, et al. (2008). Nighttime sleep problems and daytime sleepiness in Parkinson's disease. Movement Disorders 23(1):35-41.

42) Happe S, Klosch G, Lorenzo J, Kunz D, Penzel T, Roschke J, et al. Perception of sleep: subjective versus objective sleep parameters in patients with Parkinson's disease in comparison with healthy elderly controls. Sleep perception in Parkinson's disease and controls. Journal of neurology. 2005 Aug;252 (8):936–43.

43) Diederich NJ, Paolini V, Vaillant M (2009) Slow wave sleep and dopaminergic treatment in Parkinson's disease: a polysomnographic study. Acta Neurol Scand 120: 308–313.

44) Norlinah MI, Afidah KN, Noradina AT, et al. Sleep disturbances in Malaysian patients with Parkinson's disease using polysomnography and PDSS.Parkinsonism Relat Disord 2009 Nov; 15(9) :670

45) Young A, Horne M, Churchward T, et al. Comparison of sleep disturbance in mild versus severe Parkinson's disease. Sleep 2002;25:573–7.

46) Kumar S, Bhatia M, Behari M. Sleep disorders in Parkinson's disease. Mov Disord 2002;17:775–81.

47) R, Pérez-de-Heredia M, Miangolarra-Page JC, et al. 2009. Is there muscular weakness in Parkinson's disease? American Journal of Physical Medicine Rehabilitation 88:000-000

48) Wetter TC, Collado-Seidel V, Pollmacher T, et al. Sleep and periodic leg movement patterns in drug-free patients with Parkinson's disease and multiple system atrophy. Sleep 2000;23:361–7.

49) Boselli M, Parrino L, Smerieri A, Terzano MG. Effect of age on EEG arousals in normal sleep. Sleep 1998;21:351-357.

50) D. Kaynak, G. Kiziltan, H. Kaynak, G. Benbir, and O. Uysal, "Sleep and sleepiness in patients with Parkinson's disease before and after dopaminergic treatment," European Journal of Neurology, vol. 12, no. 3, pp. 199–207, 2005.

51) Avidan A.Y(2003)Recognition of sleep stages and adult scoring technique chapter edt:sudansu chokroverty,meete bhatt Robert J Thomas,Atlas of sleep Medicine 95-121

52) Arnulf L.konofal,E.merino-Andreu,et al 2002.Parkinsons Disease and sleepiness;an integral part of PD,Neurology, 58,1019-24

53) Gagnon JF, Fantini ML, Bedard MA, et al. Association between waking EEG slowing and REM sleep behaviour in PD without dementia. Neurology 2004;62:401-6

54) Diederich NJ, Vaillant M, Mancuso G, Lyen P, Tiete JProgressive sleep 'destructuring' in Parkinson's disease. Sleep Med. 2005 Jul;6(4):313-8.

55) V. dhawan d. G. healy S. pal k. ray chaudhuri, Sleep-related problems of Parkinson’s diseaseAge and Ageing 2006; 35: 220–228.

PROFORMA

Name .... Age/sex _____

Address ....

Disease Duration: ....

Currently using Drugs: ....

1) Idiopathic Parkinsons disease Yes / No
(based on BB criteria)

2) Modified Hoehn and Yahr Staging _____

3) Unified Parkinson's Disease Rating Scale (UPDRS) part III
Score ……..

4) Sleep related questionnaire (score)
1) PDSS ……..
(PDSS Sub scores ……. 2) ESS ……..

…….)

COMORBID ILLNESS	Yes	No
Asthma / COPD		
Seizures		
Diabetes		
Hypertension		
Heart Disease		
Stroke		
Chronic Kidney Disease		
Depression		
Psychiatric problems		
Nasal sinus problems		

UK PARKINSON'S DISEASE SOCIETY BRAIN BANK

CLINICAL DIAGNOSTIC CRITERIA

Step 1. Diagnosis of Parkinsonian Syndrome

• Bradykinesia
• At least one of the following
o Muscular rigidity
o 4-6 Hz rest tremor
o postural instability not caused by primary visual, vestibular, cerebellar, or proprioceptive
dysfunction

Step 2 Exclusion criteria for Parkinson's disease

• history of repeated strokes with stepwise progression of parkinsonian features
• history of repeated head injury
• history of definite encephalitis
• oculogyric crises
• neuroleptic treatment at onset of symptoms
• more than one affected relative
• sustained remission
• strictly unilateral features after 3 years
• supranuclear gaze palsy
• cerebellar signs
• early severe autonomic involvement
• early severe dementia with disturbances of memory, language, and praxis
• Babinski sign
• presence of cerebral tumor or communication hydrocephalus on imaging study
• negative response to large doses of levodopa in absence of malabsorption
• MPTP exposure

Step 3 supportive prospective positive criteria for Parkinson's disease

Three or more required for diagnosis of definite Parkinson's disease in combination with step one

- Unilateral onset
- Rest tremor present
- Progressive disorder
- Persistent asymmetry affecting side of onset most
- Excellent response (70-100%) to levodopa
- Severe levodopa-induced chorea
- Levodopa response for 5 years or more
- Clinical course of ten years or more

MODIFIED HOEHN AND YAHR STAGING

STAGE 0 = No signs of disease.

STAGE 1 = Unilateral disease.

STAGE 1.5 = Unilateral plus axial involvement.

STAGE 2 = Bilateral disease, without impairment of balance.

STAGE 2.5 = Mild bilateral disease, with recovery on pull test.

STAGE 3 = Mild to moderate bilateral disease; some postural instability; physically independent.

STAGE 4 = Severe disability; still able to walk or stand unassisted.

STAGE 5 = Wheelchair bound or bedridden unless aided

UNIFIED PARKINSON'S DISEASE RATING SCALE (UPDRS)

III. MOTOR EXAMINATION

18. Speech

0 = Normal.
1 = Slight loss of expression, diction and/or volume.
2 = Monotone, slurred but understandable; moderately impaired.
3 = Marked impairment, difficult to understand.
4 = Unintelligible.

19. Facial Expression

0 = Normal.
1 = Minimal hypomimia, could be normal "Poker Face".
2 = Slight but definitely abnormal diminution of facial expression.
3 = Moderate hypomimia; lips parted some of the time.
4 = Masked or fixed facies with severe or complete loss of facial expression;
lips parted 1/4 inch or more.

20. Tremor at rest (head, upper and lower extremities)

0 = Absent.
1 = Slight and infrequently present.
2 = Mild in amplitude and persistent. Or moderate in amplitude, but only intermittently present.
3 = Moderate in amplitude and present most of the time.
4 = Marked in amplitude and present most of the time.

21. Action or Postural Tremor of hands

0 = Absent.
1 = Slight; present with action.
2 = Moderate in amplitude, present with action.
3 = Moderate in amplitude with posture holding as well as action.
4 = Marked in amplitude; interferes with feeding.

22. Rigidity (Judged on passive movement of major joints with patient relaxed in sitting position.
Cogwheeling to be ignored.)

0 = Absent.
1 = Slight or detectable only when activated by mirror or other movements.
2 = Mild to moderate.
3 = Marked, but full range of motion easily achieved.
4 = Severe, range of motion achieved with difficulty.

23. Finger Taps (Patient taps thumb with index finger in rapid succession.)
0 = Normal.
1 = Mild slowing and/or reduction in amplitude.
2 = Moderately impaired. Definite and early fatiguing. May have occasional arrests in movement.
3 = Severely impaired. Frequent hesitation in initiating movements or arrests in ongoing movement.
4 = Can barely perform the task.

24. Hand Movements (Patient opens and closes hands in rapid succesion.)
0 = Normal.
1 = Mild slowing and/or reduction in amplitude.
2 = Moderately impaired. Definite and early fatiguing. May have occasional arrests in movement.
3 = Severely impaired. Frequent hesitation in initiating movements or arrests in ongoing movement.
4 = Can barely perform the task.

25. Rapid Alternating Movements of Hands (Pronation-supination movements of hands, vertically and
horizontally, with as large an amplitude as possible, both hands simultaneously.)
0 = Normal.
1 = Mild slowing and/or reduction in amplitude.
2 = Moderately impaired. Definite and early fatiguing. May have occasional arrests in movement.
3 = Severely impaired. Frequent hesitation in initiating movements or arrests in ongoing movement.
4 = Can barely perform the task.

26. Leg Agility (Patient taps heel on the ground in rapid succession picking up entire leg. Amplitude
should be at least 3 inches.)
0 = Normal.
1 = Mild slowing and/or reduction in amplitude.
2 = Moderately impaired. Definite and early fatiguing. May have occasional arrests in movement.
3 = Severely impaired. Frequent hesitation in initiating movements or arrests in ongoing movement.
4 = Can barely perform the task.

27. Arising from Chair(Patient attempts to rise from a straightbacked chair, with arms folded across chest.)
0 = Normal.
1 = Slow; or may need more than one attempt.
2 = Pushes self up from arms of seat.
3 = Tends to fall back and may have to try more than one time, but can get up without help.
4 = Unable to arise without help.
28. Posture
0 = Normal erect.
1 = Not quite erect, slightly stooped posture; could be normal for older person.
2 = Moderately stooped posture, definitely abnormal; can be slightly leaning to one side.
3 = Severely stooped posture with kyphosis; can be moderately leaning to one side.
4 = Marked flexion with extreme abnormality of posture.
29. Gait
0 = Normal.
1 = Walks slowly, may shuffle with short steps, but no festination (hastening steps) or propulsion.
2 = Walks with difficulty, but requires little or no assistance; may have some festination, short steps,
or propulsion.
3 = Severe disturbance of gait, requiring assistance.
4 = Cannot walk at all, even with assistance.
30. Postural Stability (Response to sudden, strong posterior displacement produced by pull on shoulders
while patient erect with eyes open and feet slightly apart. Patient is prepared.)
0 = Normal.
1 = Retropulsion, but recovers unaided.
2 = Absence of postural response; would fall if not caught by examiner.
3 = Very unstable, tends to lose balance spontaneously.
4 = Unable to stand without assistance.
31. Body Bradykinesia and Hypokinesia (Combining slowness, hesitancy, decreased armswing, small
amplitude, and poverty of movement in general.)
0 = None.

1 = Minimal slowness, giving movement a deliberate character; could be normal for some persons.
Possibly reduced amplitude.
2 = Mild degree of slowness and poverty of movement which is definitely abnormal.
Alternatively, some reduced amplitude.
3 = Moderate slowness, poverty or small amplitude of movemen

Epworth Sleepiness Scale

0 - would never doze 1- slight chance of dozing 2- moderate chance of dozing 3- high chance of dozing

Sitting and reading _____

Watching TV _____

Sitting, inactive in a public place (egtheater, meeting) _____

As a passenger in a car for an hour without a break _____

Lying down to rest in the afternoon When circumstances permit _____

Sitting and talking to someone _____

Sitting quietly after a lunch without alcohol _____

In a car, while stopped for a few minutes in the traffic _____

If your score is 10 or more, it suggests that you are abnormally sleepy and need further evaluation and treatment

PDSS SCALE

Parkinson's Disease Sleep Scale (PDSS)

How would you rate the following, based on your experience during the past week. (Place a cross at the appropriate point on the line)

1. The overall quality of your night's sleep is:	0 (Awful) 1 2 3 4 5 6 7 8 9 10 (Excellent)
2. Do you have difficulty falling asleep each night?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
3. Do you have difficulty staying asleep?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
4. Do you have restlessness of legs or arms at night or in the evening causing disruption of sleep?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
5. Do you fidget in bed?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
6. Do you suffer from distressing dreams at night?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
7. Do you suffer from distressing hallucinations at night (seeing or hearing things that you are told do not exist)?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
8. Do you get up at night to pass urine?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
9. Do you have incontinence of urine because you are unable to move due to "off" symptoms?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
10. Do you experience numbness or tingling of your arms or legs which wake you from sleep at night?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
11. Do you have painful muscle cramps in your arms or legs which wake you from sleep at night?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
12. Do you wake early in the morning with painful posturing of arms or legs?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
13. On waking do you experience tremor?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
14. Do you feel tired and sleepy after waking in the morning?	0 (Always) 1 2 3 4 5 6 7 8 9 10 (Never)
15. Have you unexpectedly fallen asleep during the day?	0 (Frequently) 1 2 3 4 5 6 7 8 9 10 (Never)

MASTER CHART

S.NO.	AGE	SEX	DURATION	STAGING	SEVERITY	PDSS	ESS	TST(min)	LAT	EFF	NIN2	SWS	REM	RBD	SNOR	AHI	SaO2	PLMS	RLS
a	50	M	2	2	12	148	0	342	5	89	N	N	3	NO	NO	0	98	0	NO
2	48	M	3	2	15	144	2	315	5	90	N	N	3	YES	NO	0	98	0	NO
3	51	F	3	2	16	142	4	375	10	84	N	N	2	NO	NO	2	92	0	NO
4	60	M	7	4	30	90	10	280	28	66	INC	DEC	2	NO	YES	10	88	8	NO
5	70	M	12	5	40	82	16	215	45	58	INC	DEC	2	NO	NO	0	98	10	YES
6	70	F	11	5	40	80	16	210	50	55	INC	DEC	2	NO	YES	10	88	10	YES
7	50	M	3	3	24	120	0	300	10	70	INC	DEC	2	YES	NO	0	94	8	YES
8	60	M	6	3	27	106	1	318	25	68	INC	DEC	2	YES	NO	0	99	0	NO
9	48	F	4	3	26	110	2	320	20	70	INC	DEC	2	NO	NO	0	95	0	NO
10	50	M	4	2.5	22	134	3	300	20	80	INC	DEC	2	NO	NO	0	96	0	NO
11	56	M	5	2.5	24	130	5	315	18	70	INC	DEC	1	NO	YES	8	86	0	NO
12	46	M	7	3	28	110	1	280	30	68	INC	DEC	2	NO	NO	0	94	0	NO
13	52	M	4	2.5	26	120	12	360	25	76	INC	DEC	2	NO	YES	10	87	0	NO
14	64	F	5	3	20	138	4	315	35	78	INC	DEC	2	NO	NO	0	96	0	NO
15	64	F	4	2.5	20	138	2	340	20	78	INC	DEC	2	NO	NO	0	95	0	NO
16	55	M	3	2	14	146	1	445	2	94	N	N	3	NO	NO	4	90	6	NO
17	51	M	3	2.5	18	142	2	420	8	85	N	N	2	YES	NO	0	96	0	NO
18	65	M	7.5	4	32	88	13	255	30	65	INC	DEC	2	NO	YES	8	86	9	YES
19	67	M	10	4	38	84	12	230	40	56	INC	DEC	2	NO	NO	0	96	8	YES
20	52	M	4	3	28	102	1	315	12	70	INC	DEC	3	NO	YES	12	85	0	NO
21	53	M	5	3	26	115	3	330	20	70	INC	DEC	2	NO	NO	0	94	0	NO
22	54	M	5	3	30	100	14	345	45	78	INC	DEC	2	NO	YES	18	80	0	NO
23	62	M	6	3	26	124	1	285	22	70	INC	DEC	2	NO	NO	0	92	0	NO
24	50	M	5	3	20	140	3	345	15	74	INC	DEC	2	NO	NO	0	95	0	NO
25	66	F	6	2.5	26	120	3	300	25	70	INC	DEC	2	NO	NO	2	92	0	NO

26	54	M	1	1	10	150	0	375	2	86	N	N	3	NO	NO	0	99	2	NO
27	60	M	7	4	34	89	11	280	30	62	INC	DEC	1	NO	NO	0	97	8	NO
28	64	M	7	4	31	82	11	240	35	60	INC	DEC	2	NO	YES	6	88	10	YES
29	54	M	4	3	25	115	2	285	20	70	INC	DEC	2	NO	NO	10	88	0	NO
30	55	M	5	3	30	100	15	315	25	70	INC	DEC	2	NO	YES	8	86	10	YES
31	49	M	6	3	28	110	2	300	25	68	INC	DEC	2	YES	NO	0	95	0	NO
32	60	M	4	2.5	20	140	3	340	20	76	INC	DEC	2	NO	NO	0	96	0	NO
33	56	M	6	2.5	30	100	4	310	30	70	INC	DEC	2	YES	NO	0	85	0	NO
34	68	F	7	3	30	98	4	280	20	68	INC	DEC	2	YES	NO	0	98	0	NO
35	60	F	5	3	26	120	3	335	25	76	INC	DEC	2	NO	NO	2	93	0	NO
36	60	M	1	1.5	11	145	0	300	6	90	N	N	3	NO	NO	0	97	2	NO
37	55	M	4	2.5	19	140	4	330	10	86	N	N	3	NO	YES	6	89	6	NO
38	61	M	8	4	36	86	14	275	25	62	INC	DEC	2	NO	NO	0	99	6	NO
39	65	F	8	4	33	84	12	260	25	60	INC	DEC	2	NO	NO	3	90	10	YES
40	58	M	6	3	27	108	3	295	22	66	INC	DEC	1	NO	YES	10	88	0	NO
41	56	F	5	3	28	105	4	310	20	68	INC	DEC	2	NO	NO	0	96	0	NO
42	52	M	4	2	22	132	1	330	20	70	INC	DEC	2	NO	NO	0	94	0	NO
43	65	M	5	3	30	100	14	310	40	78	INC	DEC	2	NO	YES	20	80	0	NO
44	60	M	4	2.5	22	130	16	300	40	80	INC	DEC	2	YES	NO	10	85	0	NO
45	62	F	4	2.5	20	136	3	300	22	74	INC	DEC	2	NO	NO	0	95	0	NO
46	48	F	4	2.5	18	142	3	320	5	90	N	N	3	NO	YES	8	88	4	NO
47	66	F	10	4	35	88	14	265	30	63	INC	DEC	2	NO	NO	0	97	8	YES
48	58	F	6	3	29	102	14	300	24	66	INC	DEC	2	YES	YES	16	81	10	YES
49	48	M	6	2	30	96	2	300	20	70	INC	DEC	2	YES	NO	0	95	0	NO
50	50	F	3.5	2	16	144	3	405	12	84	N	N	3	NO	NO	0	95	0	NO

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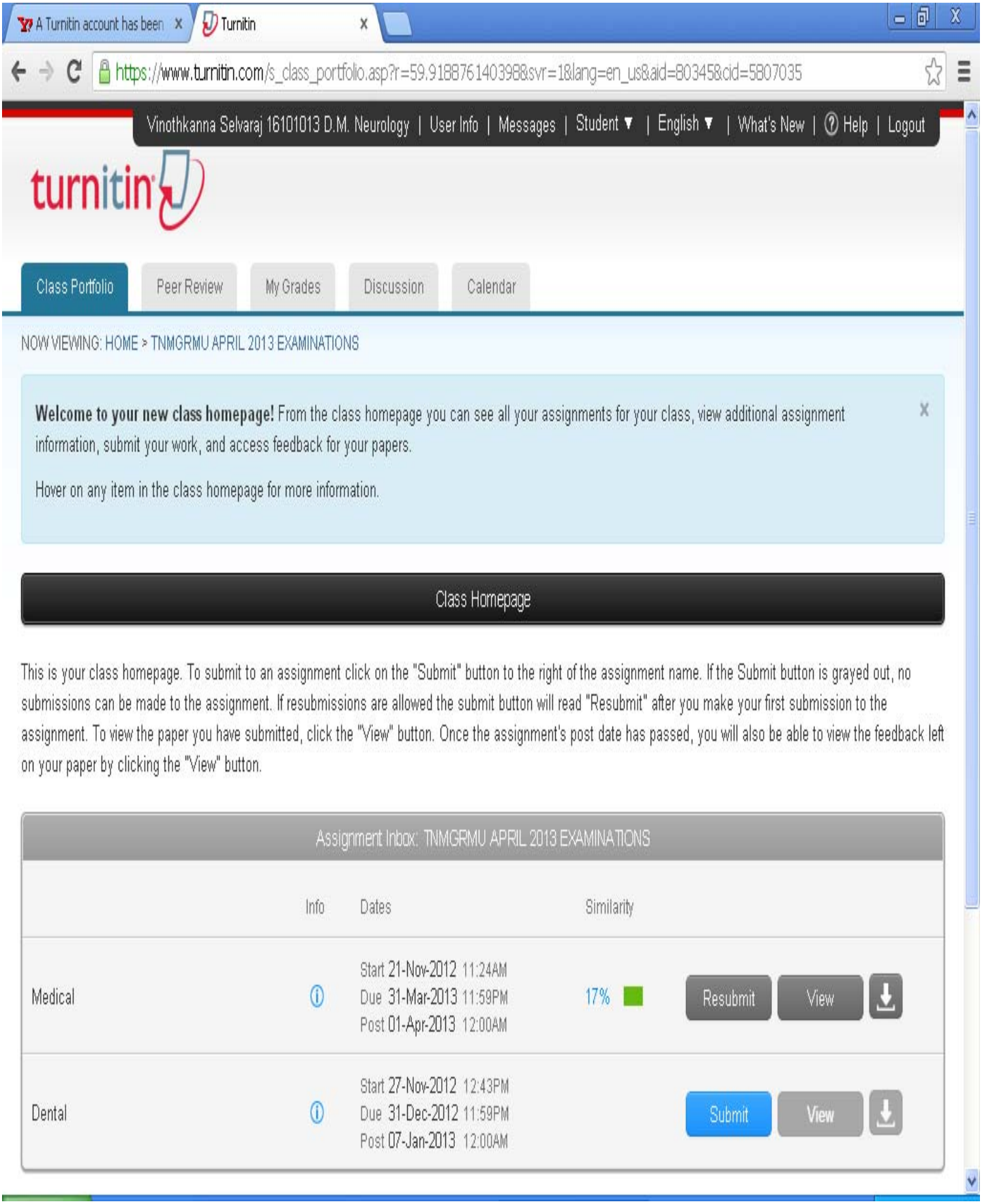
INTRODUCTION Sleep is defined as a periodic reversible physiological state of loss of consciousness from which a person can be aroused by adequate sensory stimuli and it is necessary for the recoupment and well being of the individual. We spend around 8 hours per day for sleep which means 56 hours per week, 224 hours per month and 2688 hours per year (ie) almost nearly 1/3 of our lives we spent for sleep. Sleep helps in energy conservation, physical restoration, memory reinforcement and consolidation, thermoregulation, preserving synaptic efficiency and brain plasticity, immune function, brain growth and development.2 SLEEP DISORDERS The International Classification of Sleep Disorders...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